ASTM E691-22

Standard Practice for Conducting an Interlaboratory Study to Determine the Precision of a Test Method

Significance and Use

1 ASTM regulations require precision statements in all test methods in terms of repeatability and reproducibility. This practice may be used in obtaining the needed information as simply as possible. This information may then be used to prepare a precision statement in accordance with Practice E177. Knowledge of the test method precision is useful in commerce and in technical work when comparing test results against standard values (such as specification limits) or between data sources (different laboratories, instruments, etc.).

1.1 When a test method is applied to a large number of portions of a material that are as nearly alike as possible, the test results obtained will not all have the same value. A measure of the degree of agreement among these test results describes the precision of the test method for that material. Numerical measures of the variability between such test results provide inverse measures of the precision of the test method. Greater variability implies smaller (that is, poorer) precision and larger imprecision.

1.2 Precision is reported as a standard deviation, coefficient of variation (relative standard deviation), variance, or a precision limit (a data range indicating no statistically significant difference between test results).

1.3 This practice is designed only to estimate the precision of a test method. However, when accepted reference values are available for the property levels, the test result data obtained

according to this practice may be used in estimating the bias of the test method. For a discussion of bias estimation and the relationships between precision, bias, and accuracy, see Practice E177.

2 The procedures presented in this practice consist of three basic steps: planning the interlaboratory study, guiding the testing phase of the study, and analyzing the test result data.

2.1 The planning phase includes forming the ILS task group, the study design, selection, and number of participating laboratories, selection of test materials, material certifications if applicable, and writing the ILS protocol. A well-developed test method is essential, so including a ruggedness test to determine control of test method conditions is highly recommended.

NOTE 1: In this practice, the term *test method* is used both for the actual measurement process and for the written description of the process, while the term *protocol* is used for the directions given to the laboratories for conducting the ILS.

2.2 The testing phase includes material preparation and distribution, liaison with the participating laboratories, and handling of test result data received from the laboratories.

2.3 The data analysis utilizes tabular, graphical, and statistical diagnostic tools for evaluating the consistency of the data so that unusual values may be detected and investigated, and also includes the calculation of the numerical measures of precision of the test method pertaining to repeatability and reproducibility.

Abstract
This practice describes the techniques for planning, conducting, analyzing, and treating the results of an interlaboratory study (ILS) of a test method. The statistical techniques described in this practice provide adequate information for formulating the precision statement of a test method. This practice is also concerned exclusively with test methods which yield a single numerical figure as the test result, although the single figure may be the outcome of a calculation from a set of measurements.

ASTM regulations require precision statements in all test methods in terms of repeatability and reproducibility and knowledge of the test method precision is useful in commerce and in technical work when comparing test results against standard values or between data sources.

Scope

1.1 This practice describes the techniques for planning, conducting, analyzing, and treating the results of an interlaboratory study (ILS) of a test method. The statistical techniques described in this practice provide adequate information for formulating the precision statement of a test method.

1.2 This practice does not concern itself with the development of test methods but rather with gathering the information needed for a test method precision statement after the development stage has been successfully completed. The data obtained in the interlaboratory study may indicate, however, that further effort is needed to improve the test method.

1.3 Since the primary purpose of this practice is the development of the information needed for a precision statement, the experimental design in this practice may not be optimum for evaluating materials, apparatus, or individual laboratories.

1.4 Field of Application—This practice is concerned exclusively with test methods which yield a single numerical figure as the test result, although the single figure may be the outcome of a calculation from a set of measurements.

1.4.1 This practice does not cover methods in which the measurement is a categorization; however, for many practical purposes categorical outcomes can be scored, such as zero-one scoring for binary measurements or as integers, ranks for example, for well-ordered categories and then the test result can be defined as an average, or other summary statistic, of several individual scores.

1.5 *This standard may involve hazardous materials, operations, and equipment. This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility*

of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.

1.6 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*